

ficially heated were used for the cultivation of tender plants. Since then, however, the evolution of the greenhouse has been rapid. There are now glass structures, acres in extent, so cleverly made that the cultivation of plants in them is as successful as in the open with the most favourable weather conditions. The market gardeners of England have in the last fifty years made great progress in the art of glasshouse gardening, and in the United States, where the sun affords in winter more heat and light than it does here, huge structures are erected for the forcing of flowers and vegetables.

Mr. Wright, director of the New York State School of Agriculture and formerly a professor of horticulture, has collected in his book a large amount of helpful information concerning the location, adaptation, erection, and equipment of greenhouses to suit American weather conditions and requirements, which both builders and gardeners will be certain to appreciate.

The conditions in England are somewhat different; still, a great deal of Mr. Wright's teaching may be applied in the making of houses, frames, etc., in this country, and in methods of heating them. Our old greenhouses are too heavy and obstruct the light too much. A good plant-house must be strong, yet light, and it must cast very little shade. The angle of the roof, quality of glass, methods of ventilation, and the internal arrangements with respect to benches and floors are all questions of great importance, as Mr. Wright clearly shows in his well-illustrated chapters.

(2) Vegetable forcing as practised in the United States is the subject of an excellent treatise by Mr. Watts, Dean and Director of the School of Agriculture and Experiment Station at Pennsylvania State College. Forcing as practised in horticulture is the application of artificial heat to the growth of plants out of season. It is now very largely resorted to for the production of food vegetables in winter, enormous quantities of fresh, wholesome vegetables being grown in this and other countries where, without it, they would be difficult to obtain. It is also largely practised for the production of certain flowers, especially roses, carnations, daffodils, and violets. Where sunshine in winter is fairly constant successful forcing is easy, as, for instance, in the United States, where there is far more winter sunshine than in England. In greenhouses and frames specially constructed for the purpose perfect crops are produced in mid-winter of such vegetables as cabbage, cauliflower, lettuce, radish, tomato, cucumber, rhubarb, asparagus, French bean, and mushroom. A knowledge of the treatment of soils, suitable manures, right temperatures and ventilation is necessary, and is best obtained by actual experience. Useful guidance can also be obtained from books, such as that by Mr. Watts, which sets forth the best methods of the American practitioners. They believe in soil sterilisation by means of steam or formalin. It is found that the soil continues to be productive year after year when it is annually sterilised, whereas

without this it becomes "sick" and infested with fungi and other causes of disease in plants. Stable manure is preferred to all other fertilisers, but nitrate of soda is sometimes used as a growth stimulator. Greenhouse construction, heating, insect enemies and diseases, and marketing are carefully treated. The statement that plants are rendered susceptible to disease by high temperatures, excess of water, and over-manuring will be endorsed by practical cultivators in this country.

(3) The propagation of fruit trees by means of grafting, budding, layering, and cuttings is essentially the same in all countries. The methods vary, as does the skill with which the operations are performed. In America, where fruit-growing is done on a very large scale, labour-saving methods are practised. Orchards miles in area have to be planted and worked, for which men with spades and pruning-knives would be as inadequate as they would be for agriculture. The alert Americans have therefore sought the assistance of the machine-maker for their digging and planting operations, and even for binding in the operation of grafting.

Prof. Brown's book enables us to realise what a big industry fruit-growing has become in America. There are nurserymen there who each dispose of young trees by the million annually. "The growing of all the twenty to forty millions of American-grown apple seedlings that are used in this country every year is undertaken by less than a dozen firms." In addition, large quantities of young trees, both stocks and "maidens," are imported from Europe. At this rate America will soon be covered with fruit trees unless they are used up quickly, as roses are in that country. Some of our own fruit authorities advocate this intensive system on the ground that young trees properly managed give their best in the first few years, after which they should be scrapped. Apples, pears, plums, cherries, peaches, and a few other fruits are invariably grafted or budded on stocks known to influence growth and fruitfulness. Too little care, however, is exercised in the selection of stocks. Prof. Brown discusses the influence of scion on stock in regard to commercial fruit trees. His book is written for students, a number of what he calls "review questions" being set out at the end of each chapter, such as "What is meant by influence of stock over scion?" It contains numerous helpful illustrations.

W. W.

ANALYTICAL DYNAMICS.

A Treatise on the Analytical Dynamics of Particles and Rigid Bodies: with an introduction to the Problem of Three Bodies. By Prof. E. T. Whittaker. Second edition. Pp. xii+432. (Cambridge: At the University Press, 1917.) Price 15s. net.

THE first edition of this book was reviewed in NATURE of April 27, 1905. At that time what we now call aeroplanes only existed in

people's imagination and in reports of successes by the Wright brothers, and it was scarcely to be wondered at if applications to aerial navigation found no suitable place in a treatise on analytical dynamics. In the twelve years that have elapsed there has been plenty of time for pure and applied mathematicians to provide material that would not occupy merely a single chapter on "The Aeroplane" in a second edition of such a book as this, but might even form a predominating feature of the whole work. Yet on referring to the index we do not even find the word "aeroplane," while the references under "stability" and "resistance of the air" do not lead to any matter suggestive, even vaguely, of the existence of aerial navigation. It may well be a matter of surprise that such an omission should be possible at the present day.

We cannot lay the blame on Prof. Whittaker, because a book of this kind is necessarily largely an exposition and collation of the work of other writers. But it will be found on closer examination that, outside the problem of small oscillations about a state of steady motion, very little work has been done in advancing what is really out-and-out the most important development of theoretical dynamics, and for the most recent of the developments which have taken place physicists and engineers rather than mathematicians are mainly responsible, much of their work being the property of the Government at present.

It is, however, rather a pity that Prof. Whittaker has omitted to introduce the subject under the heading of "stability of steady motion," as this would, at least, afford his readers some stimulus to turn their studies in the right direction. Possibly the author considered it scarcely desirable to make any change until further developments had taken place, and in this second edition he has rather confined his attention to elaborating references to original work on old ground. It is not usual in reviews to repeat what has been said in a previous notice about a first edition. For this reason a detailed account of the actual contents would be scarcely necessary or desirable. The present work will be found of much use by such students of a future generation as are able to find time to extend their study of particle and rigid dynamics outside the requirements of aerial navigation, and it will also afford a valuable source of information for those who are in search of new material of a theoretical character which they can take over and apply to any particular class of investigation.

G. H. B.

OUR BOOKSHELF.

Origenes y Tendencias de la Eugenia Moderna.
By Joaquin Bonilla. Pp. 96. (Liverpool: Daily Mail (printers), 1916.) Price 3s. 6d. net.

This introduction to eugenics is intended primarily for Latin America. The author explains the aims

of eugenics, and gives a sketch of the history of the idea of trying to control the agencies which improve or impair racial qualities in mankind. Simple expositions are given of Lamarckism, Darwinism, Mendelism, and Weismannism. There is a pleasant appreciation of the work of Sir Francis Galton, and the book pays due regard to experimenters and biometricians alike. The endeavours of the Eugenics Education Society are recognised, as well as the work of Prof. Karl Pearson's Eugenics Laboratory. So up-to-date is the book that mention is made of England's "Baby Week" and of the withdrawal of the veto on the representation of certain plays by Ibsen and Brieux. A chapter is devoted to eugenic activities in the United States.

The author has the wise and kindly intention of familiarising Spanish-speaking young people with the aims and methods of eugenics, and he seems to us to have written a clear and terse introduction to the subject. We should like to have seen some recognition of what is practicable in the way of ameliorating environment and function, and improving nurture generally. For the eugenic ideal does not, and cannot, stand alone. In a short book like this it should have been readily possible to avoid disfiguring verbal errors, such as Seleeby, Burcke, Havelock Elliott, and Weisner; but these are very small flies indeed in the carefully prepared ointment. We wish the book success.

The Human Body: An Account of its Structure and Activities and the Conditions of its Healthy Working. By Prof. H. Newell Martin. Tenth edition, thoroughly revised by Prof. E. G. Martin. Pp. xviii+649. (New York: H. Holt and Co., 1917.)

A book which has reached a tenth edition needs but little recommendation. The late Prof. Newell Martin's work, like all that he did, is excellent. It is rather more bulky than the majority of books of an elementary nature; but, like these, it is a compendium of anatomy and physiology designed, not for the student of medicine, but for the general reader who desires to become acquainted with the mechanism of his own body and the reasons for the laws of health. It is naturally the physiological side which is mainly dwelt upon, only so much of structure being described as is necessary for the understanding of function. The present edition has been brought well up to date, and, like the only other book with which we may compare it, Huxley's "Elementary Physiology," has doubtless still before it a long and useful life.

A welcome feature of the book is the appendix, in which instructions for practical work are given in detail. Much of this will need a laboratory, but it is astonishing how much useful practical work can be performed without elaborate apparatus, and with the resources which are available to nearly every teacher.